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ABSTRACT

This report offers guidelines for appropriately interpreting and using "teacher effects" research (research linking teacher behavior to student outcomes). Attention is given to the potential uses and abuses of such research, and limitations of the nature and use of scientific data on teacher effects are discussed. Ways that instructional principles can be derived for research findings are suggested, and implications for teacher educators and school administrators are also considered. (CB)

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Abstract

Research linking teacher behavior to student outcomes has direct relevance to practice, and if used appropriately, will have the same personalizing and empowering effects (i.e., not deskilling effects) on teachers that the development of a knowledge base underlying medical practice has had on physicians. However, this assumes that certain common mistakes are avoided when deriving instructional principles from these findings and using them as the basis for preservice teacher education programs, induction programs for new inservice teachers, or teacher evaluation and accountability programs. Toward that end, this article offers guidelines for appropriately interpreting and using teacher effects research (and thus for avoiding its misuse).

RESEARCH ON TEACHER EFFECTS: USES AND ABUSES

Jere Brophy[1]

> Ideally, teaching is a technology for producing learning, informed by scientific data linking teacher behaviors to student achievement measures. Schools will fulfill their missions most effectively when teachers are trained to follow scientifically developed guidelines for instruction and then monitored to ensure compliance enforced through rigorous accountability procedures.
>
> On the contrary, teaching is and always will be an art. Attempts to legislate instruction and turn teaching into a technology are doomed to failure. Schools work best when individual teachers use their professional knowledge and experience to decide what to teach and how to teach it to the particular students in their classes.

These are two perspectives that might be taken on questions concerning the relevance and use of scientific data linking teacher behavior to student outcomes. In my view, they are inappropriate perspectives--each contains grains of truth but is too extreme and rigid to fit the facts. This article offers a more balanced and differentiated perspective on the same issues, focusing specifically on how research linking teacher behavior to student achievement might be used in educating teachers and evaluating their instruction. Using the role and functioning of the public school teacher to provide a context, it considers a variety of application issues and then addresses implications concerning preservice teacher education, induction programs for new teachers, and teacher evaluation.

Until recently, these issues were largely moot because there was no established body of research linking teacher behavior to student outcomes. In the last 15 years, however, process-outcome research linking teacher behavior

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to students outcomes (and especially to student achievement gain) has made enormous strides. What began as a limited collection of scattered results that did not hang together well to form easily interpretable patterns has grown into a sizable collection of replicated correlational findings, many of which have been validated experimentally. Furthermore, as the findings have become better understood and integrated, they have become the core of a small but well-established and growing knowledge base capable of informing teacher education and teaching practice.

These findings will be familiar to most readers, so they are summarized only briefly here (see Brophy & Good, 1986, for extended review and discussion). The most consistently reported and replicated of these findings concern the quantity of academic instruction that students receive from their teachers. Amount learned is determined in part by opportunity to learn (exposure to content). In turn, opportunity to learn is determined by the degree to which teachers (a) are businesslike and task-oriented, emphasize instruction as basic to their role, expect students to master the curriculum, and allocate most classroom time to activities with academic objectives rather than to activities with other objectives or no clear objectives at all; (b) use classroom organization and management strategies that maximize the time students spend engaged in academic activities and minimize the time teachers spend getting organized, handling transitions, or dealing with misconduct; (c) pace the students briskly through the curriculum, but also see that they make continuous progress all along the way, moving through small steps with high or at least moderate rates of success and minimal confusion or frustration; and (d) spend most of their time actively instructing their students in group lessons or supervising their work on assignments rather than expecting them to learn primarily on their own through independent reading and seatwork.

In addition to these findings concerning quantity of instruction, there are findings concerning the quality of instruction indicating that achievement gains are greater when teachers (a) not only make frequent presentations and demonstrations but do so in ways that include sufficient enthusiasm of delivery, clarity and specificity of language, logical sequencing of the content, and structuring of the content in ways that help students recognize it as an integrated whole and appreciate the relationships among its parts (through advance organizers, outlining, signaling of transitions, calling attention to main ideas, and summarizing); (b) ask clear questions pitched at appropriate levels of difficulty (so that most students can understand and respond adequately to them) and allow students sufficient time to process and begin to formulate answers before calling on one of them to respond; (c) provide clear and informative feedback to students' answers; (d) seek to elicit improved responses when students answer incorrectly or fail to answer at all; (e) answer or redirect relevant student questions and incorporate relevant student comments into the lesson; (f) prepare students for follow-up assignments by reviewing the instructions and working through practice examples with them until they are clear about what to do and how to do it; (g) circulate to provide supervision and help to students as they work on assignments (or if this is not possible, making sure that assignments are challenging enough to constitute meaningful learning experiences yet easy enough to allow students to attain high levels of success if they put forth reasonable effort, and making sure that those who still need help know when and how to get it).

Professional Knowledge as Potential Power

What are the potential uses and abuses of these findings linking teacher behavior to student achievement gain? What is an appropriate stance that

educators (including not only classroom teachers but school administrators and teacher educators) might take with respect to them? The remainder of this article addresses these issues.

Let us begin by noting that these findings have a special, direct relevance to teachers' practical concerns. Unlike most other educational research (e.g., national assessments of educational progress, surveys of teachers' attitudes and practices, studies of child development and learning, etc.), findings concerning teacher effects link teacher behaviors to student outcomes. Such information, especially as it becomes better organized and integrated around key theoretical concepts, constitutes a knowledge base capable of undergirding professional educational practice. If this knowledge base continues to develop and is appropriately exploited through effective professional education, it has the potential to empower teachers by providing them with useful information to draw upon when making professional decisions (e.g., information about what strategies would be appropriate for use in a particular situation and which of these might be considered the "treatment of choice" under the circumstances).

Knowledge about teacher effects can be either empowering or limiting to teachers, depending on how it is used. Educators who view teachers as autonomous artists tend to see such knowledge as restricting teachers' freedom and thus resist it. Two points must be made in response to this attitude. First, it is neither realistic nor appropriate to expect teachers to exercise total autonomy in defining and doing their work. Like any other professionals, teachers are subject both to formal laws and to informal expectations and codes of conduct based on professionally accepted standards for good practice. Furthermore, teachers are (appropriately) subject to additional regulation because they work in institutions (schools) that are established and maintained by

social communities (not by teachers as individuals or even by education as a profession). Communities establish schools to educate their youth, so decisions about educational policy and practice should be made with input not only from teachers but from society at large (as represented by federal and state agencies, local school boards, and school administrators). Furthermore, the primary consideration that should determine such decisions is the degree to which proposed policies or practices further the primary goals of schooling. It is desirable and important that teachers obtain personal gratification and professional self-actualization from their work, but this must occur (to the extent possible) within the context of providing the best possible education for the students whom the schools were established to educate in the first place.

The second point is that if it is used appropriately, information about the effects of teaching practices is much more empowering than limiting to teachers because it allows them to act confidently on the basis of well-established principles rather than to have to rely on trial-and-error learning or on whatever techniques they have seen modeled during visits to other teachers' classes. An analogy to the medical profession illustrates this point. As my colleague Charles W. (Andy) Anderson points out, if we had the choice of going to our regular physicians or to reincarnations of historically prominent physicians such as Galen or Hippocrates, we would stick with our regular physicians because they give us access to the vital medical knowledge and technology that has been developed since Galen or Hippocrates lived. Far from oppressing modern physicians or turning them into deskilled technicians, the proliferation of the knowledge base that undergirds the practice of medicine has had primarily empowering effects.

Modern physicians can confidently follow safe and efficient routines for doing things that were once chancy and dangerous, and they can do a great many things that were unknown to medical pioneers. These advances have brought responsibilities as well (physicians can be sued for malpractice), but their primary effects have been to improve the quality of medical practice and to increase physicians' success rates in responding to medical problems. As much as ever before, modern medical practice demands professional judgment and offers opportunities for artistry and creativity, but in addition to, rather than in the absence of, systematic application of scientific knowledge and technical skill. Teachers can look forward to similar developments in the quality and effects of educational practice as the knowledge base undergirding their profession expands.

Some such developments are already in evidence. For example, just 20 years ago teachers interested in learning about classroom management strategies were offered only vague and often conflicting advice that usually was not based on systematic research in classrooms. Since then, however, research on classroom organization and management has produced a stable and informative knowledge base (reviewed in Doyle, 1986, and Good & Brophy, 1987) offering principles that teachers can adopt with confidence, knowing that they are associated not only with better student engagement in classroom activities but ultimately with better student achievement. Teachers who may have wondered whether it was worth spending significant time early in the school year making sure that students learned and followed basic classroom rules and procedures now know that such allocation of their time is not only worthwhile but vital to successful establishment of a management system that will function effectively throughout the year. Similarly, teacher effects research enables teachers to proceed

with confidence in knowing that their interactive instruction of students provides important input and opportunities for clarification and elaboration of learning that students do not get consistently from reading texts or working on assignments, that time spent orienting students through advance organizers and calling their attention to important structuring elements will enhance their understanding of and memory for information, that it is usually better to address questions to the class as a whole (and then call on an individual to respond) than it is to designate a respondent before asking the question, and that it is important to wait for a response (and if necessary to probe or rephrase the question) when students do not respond (rather than to give the answer quickly or move on to someone else for fear of putting the student "on the spot").

In summary, because of the direct relevance and potential empowerment effects of information linking teacher behavior to student outcomes, it is counterproductive, if not unprofessional, to dismiss it out of hand on the basis of misguided notions about teacher artistry or autonomy. On the contrary, all teachers should be made aware of this information and stimulated to think about how it might apply to their practice. The information must be formulated accurately, however, and presented to teachers in appropriate ways. I recognize (and as one of the researchers who has generated the information, I am very troubled by) the fact that such information can be misused in ways that not only fail to empower teachers but limit their effectiveness by subjecting them to overly rigid or otherwise inappropriate prescriptions. Such misuse of this information stems in part from failure to recognize the limitations of scientific data in general and of existing teacher effects data in particular.

Limitations of the Nature and Use of Scientific Data on Teacher Effects

As a first principle, it is important to recognize that neither teacher effects data nor any other scientific data can directly prescribe guidelines for practice. Scientific findings can identify effective ways to attain given sets of prioritized educational objectives, but they cannot make decisions for educators about what the objectives should be or how they should be prioritized. These are policy decisions to be made on the basis of moral, social, and political values. In effect, those who attempt to finesse these decisions by prescribing teacher behavior strictly on the basis of teacher effects data are using achievement test gain as their sole educational objective, to the exclusion of all other considerations.

This is why I refer to "teacher effects" data rather than to "teacher effectiveness" data in discussing research linking teacher behavior to student achievement. "Teacher effectiveness" is a broad term that has meaning only in reference to a set of prioritized educational objectives, and most educators would want to consider several other objectives besides achievement test gain in defining and assessing teacher effectiveness (developing student interest in subject matter, fostering the personal adjustment and mental health of individual students, developing a prosocial, cooperative group atmosphere in the class, etc.).

As an example illustrating the fact that teacher effects data cannot be translated directly into prescriptions for practice, consider the debates over length of school day or school year. Research has shown that amount learned is related to time spent learning. Although this relationship is less direct and powerful than most would suppose, it is clear that students would achieve more if they attended school for more time per day or more days per year. By

itself, however, this scientific information does not constitute an argument that time spent in school should be increased. To construct such an argument, it would be necessary to convince others that: (a) what students are learning at present is "not enough" by some persuasive criterion; and (b) lengthening the time spent in school is a necessary response to this problem or at least is preferable to other potential responses (toughening standards, improving curricula, improving teaching, etc.). Clearly, this would require consideration of values, cost/benefit trade-offs, and a great many other things in addition to data on teacher effects.

In addition to recognizing that no scientific data will ever be able to do their thinking about goals and priorities for them, educators interested in developing instructional guidelines need to recognize several limitations on existing teacher effects data that must be kept in mind if this information is to be used but not misused. One is that most of these data relate teacher behavior only to achievement outcomes. Few teacher effects studies have considered affective outcomes (self-concept, liking for the class and the subject matter, personal and social adjustment, classroom atmosphere, etc.). Consequently, prescriptions for maximizing student achievement gain that might be derived from these data (e.g., maximize the time that students spend in activities designed to foster mastery of the formal academic curriculum) would have to be altered in developing guidelines for accomplishing a broader range of objectives (some of the available time would have to be allocated to nonacademic activities intended to promote progress toward affective objectives).

Even within the realm of achievement outcomes, most of the existing process-outcome research has focused on activities designed to accomplish lower level (knowledge and skill development) objectives, and in particular, on the kinds

of achievement outcomes that are measured efficiently with paper-and-pencil tests. This also implies limits on the applicability of principles derived from this research. Such limits are not as stringent as they might appear to be at first, because most instruction in most subject matter areas is targeted to lower level objectives, so that principles derived from process-outcome research would apply to it. Specifically, it appears that such principles would apply to instruction in any body of knowledge or set of skills that has been sufficiently well organized and analyzed so that (a) it can be presented systematically, and then (b) practiced or applied during activities that call for student performance that (c) can be evaluated for quality and (d) can be given corrective feedback (where incorrect or imperfect). This would include not only basic knowledge and skills in any subject matter area but also certain aspects of higher level activities such as reading comprehension and study skills, mathematics problem solving, and scientific experimentation.

For example, research on the teaching of reading comprehension skills indicates that many students need much more than mere exposure to concepts (such as main idea) and associated exercises (such as finding the main ideas in paragraphs) if they are to become strategic readers who not only know about but routinely use skills for processing information and comprehending what they read. Nor are they likely to profit much from brief mention of the value of paraphrasing or summarizing the content of a paragraph in one's own words, generating questions to test one's understanding, or searching the context for clues to the meaning of unfamiliar words. In order to learn and be able to use such skills routinely in the process of becoming strategic readers, most students will need frequent modeling of the skills (which the teacher presents by "thinking out loud" while reading paragraphs with the intention of gaining

clear understanding of their meaning) as well as explicit explanation not only about what the skill is and how to use it but also about when and why to use it (Duffy et al., 1986; Paris, Cross, & Lipson, 1984). Similarly, students learning mathematical problem-solving skills need not only practice in applying procedural algorithms to well-structured problems but also modeling and explicit instruction in strategies for identifying relevant information and formulating poorly structured problems accurately, as well as strategies for analyzing, simplifying, and developing methods for solving unfamiliar problems (Romberg & Carpenter, 1986; Schoenfeld, 1979).

Also, research in science teaching has shown that students often harbor misconceptions (e.g., that plants take in food from the soil) that conflict with the scientific conceptions they are supposed to be learning (e.g., that plants manufacture their own food as part of the process of photosynthesis). Such misconceptions are likely to persist and distort what the students learn from listening to the teacher, reading the text, or even conducting experiments in the laboratory, unless the misconceptions are brought to the surface and confronted directly through a form of active instruction known as "conceptual change teaching" (Anderson & Smith, 1987). Here, the teacher explicitly compares the misconception with the scientific conception and questions the students to ensure that they understand the differences between these two conceptions and their implications about the topic at hand. Once misconceptions are replaced with accurate scientific conceptions, students can work from accurate premises when thinking through scientific problems and can develop complete and accurate understandings of what is occurring during scientific experiments and what this implies about the scientific principles under study.

These examples illustrate that principles of active instruction apply not only to the teaching of knowledge and skills that are included in the curriculum because they are considered to be important in their own right, but also to instruction in knowledge and skills that are taught because they are prerequisites to accomplishment of higher level objectives. If both of these factors are taken into account, it can be said that principles of active teaching will apply to most of what is taught in school.

In contrast, these principles will not apply to teacher behavior during activities designed primarily to create a process rather than a product (debate, discovery, discussion, role play, simulation, etc.), or during activities that call for students to discover or invent their own response rather than to follow a prescribed process to reach a predetermined outcome (interpretation of poetry or literature, creative writing, artistic expression, etc.). To date, not much scientific information is available on effective strategies for accomplishing such higher level cognitive objectives with students. It seems obvious, however, that such objectives will not be achieved if all classroom time is allocated to activities with lower level objectives. Thus, in addition to instructing students actively by presenting information, demonstrating skills, conducting recitations, and supervising practice on assignments designed to develop mastery of basic knowledge and skills, teachers will also need to schedule debates, discussions, simulation activities, book reviews, research projects, creative writing assignments, problem-solving activities, assignments calling for development or construction of products, or other opportunities for students to apply, analyze, synthesize, or evaluate what they have been learning.

Another limitation on existing teacher effects data is that they are much more informative about the quantity of instruction (how much active teaching

occurs) than about its quality (what forms it takes and how well it is implemented). This is because, although it has made important contributions, most of the process-outcome research done so far has been designed in ways that inherently limit the nature and degree of specificity of the findings that it is capable of producing. Three limitations in particular should be noted. First, the samples usually included teachers who were poor classroom managers or who for whatever reason did not spend much time actively instructing their students or keeping them profitably engaged in academic activities. This virtually ensured that quantitative measures such as active instruction time or student engaged time would emerge as the most powerful correlates of achievement gain.

Second, the process data usually were collected using methods that emphasized how often teachers did things rather than how well they did them. This minimized the likelihood that subtle qualitative differences in teacher behavior would be studied in the first place. Third, the data typically were analyzed by correlating teacher behavior scores averaged across many classroom observations with class average scores on standardized achievement tests. This made it likely that reliable but subtle effects of qualitative differences in teacher behavior, even if measured, would be masked by the much more powerful effects associated with differences in active teaching time and other quantitative measures.

As a result of these limitations, existing process-outcome data say more about the amount than about the quality of instruction associated with student achievement gains. A related point is that these data mostly reflect the differences between (a) the 25% or so of teachers who are the least successful in eliciting student achievement gain and (b) all other teachers; that is, these

data identify key differences between teachers who instruct their students poorly or not at all and teachers who instruct their students adequately or better. Not much information is available yet on the differences between teachers who are outstanding instructors and those who are merely adequate or average. Such information is beginning to be accumulated, however, by researchers who have begun to exert more control over the range of classroom management skills and time allocation preferences of the teachers in their studies, to include more qualitative measures of instruction, and to search for more specific and context-bound relationships between teaching and learning of particular content or skills.

In summary, the principles that can be derived from existing teacher effects research are mostly limited to general guidelines that focus on achievement gain to the exclusion of other potential objectives, focus on fundamentals rather than on more sophisticated fine points of instruction, and focus on quantitative rather than qualitative aspects of instruction. Consequently, these principles have limited value for those inservice teachers who routinely elicit impressive achievement gains from their students, but they should be valuable for educating preservice teachers and reeducating those inservice teachers who have not enjoyed much success in eliciting student achievement gain. The principles imply four possible reasons for low achievement gain in some inservice teachers' classes.

Two of these reasons are suggested by the findings indicating that high achievement gain is associated with placing high priority on achievement gain as a goal and adopting congruent defintions of the teacher's role, adopting high but realistic expectations about the students' ability to master the curriculum and the teacher's ability to teach it to them, and allocating most of

the available time to academic activities so as to maximize content coverage and student opportunity to learn. By implication, these findings identify two types of teachers who will be relatively unsuccessful in eliciting achievement gains from their students: (a) teachers who are burned out or who for whatever reason are not committed to any clear-cut clear-cut educational goals (those who devote a great deal of classroom time to busywork or noneducational pastimes) and (b)teachers who place a high priority on affective or social outcomes but a low priority on achievement outcomes (so that less of the available time is spent instructing the students in the formal curriculum).

Given the complexity of teachers' work and the many demands and frustrations that are sometimes associated with it, burned-out or apathetic teachers may need better administrative support, improvements in the quality of the workplace, or personal counseling more than they need inservice education concerning instructional goals and strategies. However, to the extent that such teachers have become burned out or apathetic due to a history of failure and frustration, exposure to teacher effects data might help them to break out of their "learned helplessness" and become willing to invest effort in self-improvement programs. After all, most teacher effects findings are based on studies of ordinary teachers working under typical classroom conditions, and experiments based on these findings have shown that teachers can learn to follow guidelines for classroom management and instruction that enable them to elicit significant increases in their students' achievement gains.

Teachers who place high priority on affective or social outcomes but low priority on achievement outcomes may be less interested than other teachers in principles derived from existing teacher effects research, but even these teachers should be interested in getting maximum benefit out of the time that they

do devote to academic objectives and in developing confidence that they can pursue these objectives reliably and efficiently. Furthermore, there is some reason to believe that improvements in the instruction that they do target to cognitive goals may enhance the effectiveness of their efforts to achieve affective goals. Prawat (1985) reported that teachers who were balanced in emphasizing both cognitive and affective goals were more successful in achieving both sets of goals with their students than were teachers who placed high priority on affective goals but low priority on cognitive goals.

The findings concerning classroom management effectiveness and student engaged time identify a third class of teachers who tend to be unsuccessful in eliciting student achievement gain: those whose success is limited by their own poor classroom management skills. Such teachers could benefit from research-based classroom management inservice programs, which have proven effective in enabling teachers to increase their students' engagement rates and ultimately their achievement levels (Evertson, 1985).

The findings on active instruction identify a fourth class of teachers who stand to benefit from exposure to principles derived from teacher effects research: teachers who expect their students to learn mostly on their own by reading and doing assignments or by working their way through sequences of individualized learning modules, rather than expecting to spend considerable time personally carrying the content to the students through active whole-class or small-group instruction. Materials-based approaches can work in special resource rooms and other settings featuring low student/teacher ratios, but they usually do not work well in ordinary classrooms where one teacher must work with 20-40 students. The problem is not with the theory of individualized instruction that calls for beginning where students are and moving

them along at their own pace. Instead, the problem is that in practice, individualized instruction in the typical classroom (a) shifts a great deal of responsibility for planning and managing learning from the teacher to the students themselves, and (b) shifts a great deal of responsibility for carrying the content to the students from the teacher to the materials. This can succeed and may even have certain advantages when the teacher is continually available to provide close supervision and immediate help when needed, but it does not work well when students must work on their own for extended periods of time and have to learn by interacting with the curriculum materials without getting much guidance or help from the teacher.

Unfortunately, many of today's veteran teachers not only were educated before most of the presently available teacher effects findings were published, but also were educated as "instructional managers" to implement "teacher-proof curricula" and other approaches that relied heavily on curriculum materials to carry the content to the students. Such teachers (and their students) stand to benefit significantly from inservice education that recognizes the importance of good texts and assignments but also stresses the need for teachers to instruct actively by providing students with objectives and advance organizers to guide their study efforts, introducing new terms and developing key concepts, bringing student misconceptions to the surface and confronting them, elaborating in places where text is vague or sketchy, supplying analogies or examples to help students relate strange or abstract concepts to familiar experiences, supplementing the text by supplying important additional content, helping the students to organize and remember the material by noting key structuring elements or supplying outlines, checking student understanding and providing correction through recitation and other guided practice activities, providing

opportunities for the students to discuss or apply what they are learning, and in general, teaching students actively.

Deriving Instructional Principles from Research Findings

Research findings do not translate directly into guidelines for practice. Instead, the meanings and implications of the findings must be interpreted. This is why, when speaking of educating teachers, I have referred more often to principles derived from teacher effects findings than to the findings themselves. Even where findings are well established and no one disputes the basic facts, there may be considerable disagreement about how the findings should be interpreted and what they imply about effective teaching.

Responsibility for sensible interpretation of scientific data begins with the researchers who originally collect the data and the editors and referees of the journals in which they publish their findings. It is vital that these individuals see that clear and complete information is given about the contexts within which data were collected, the measuring instruments, and the procedures followed in processing and analyzing the obtained scores; that the findings themselves are described clearly; and that statements of fact are distinguished from interpretations or opinions when discussing the data. Commonly made errors of interpretation (to be described below) should be avoided.

If the researchers who collect the data in the first place consistently report their findings accurately, and if scholarly reviewers begin to contribute accurate syntheses of the findings emerging from developing research literatures, a stable knowledge base of factual information will develop. This will take time, however, and the information will still have to be interpreted with an eye toward its implications for teachers. At least initially, scholarly reviewers can be expected to disagree, and both they and other educators may

misuse teacher effects data by developing prescriptions from it that are overly generalized, too rigid, or otherwise incorrect. This can occur even if these interpreters are mindful of the limitations on the research described in the previous section, because there is a great deal of room for error in interpreting the meanings and implications of teacher effects findings, and certain errors have been made repeatedly. In this section, I offer some guidelines for avoiding such errors when attempting to induce instructional principles from research findings.

First, it is unwise to try to make too much of the findings of a single study. Not all reported findings have been replicated, and even replicated findings may apply only to certain situations (such as small-group reading instruction in the early grades). Also, even well replicated correlations between a teacher behavior and student achievement do not necessarily indicate that the teacher behavior causes the achievement gain. It is possible instead that student behavior causes the teacher behavior (high rates of praise, low rates of criticism, and low rates of intrusive disciplinary interventions all are more likely in classes full of bright and well motivated students than in classes full of alienated low achievers). Even more likely, it is possible that both student achievement gain and certain correlated teacher behaviors are caused by other, more fundamentally important, teacher behaviors (rates of teacher praise of student answers to recitation questions tend to correlate with achievement gain, but these correlations probably exist not so much because such teacher praise actually causes student achievement but because it occurs during recitation activities and thus indicates indirectly that the teacher spends a good deal of time actively instructing the students during group lessons).

To make sensible use of research findings, then, one cannot simply take the findings of a single study (or for that matter, even the results of meta-analyses averaging effects across many studies) and translate these directly into prescriptions for teachers. Instead, one must begin by assessing all of the literature available on a teacher behavior to determine the strength and consistency of its relationship to achievement gain, the degree to which there is evidence that the relationship is causal rather than merely correlational, and the nature of any limitations or qualifications on its generalizability across different teaching situations. Assuming that there is reason to believe that the teacher behavior does facilitate student achievement, and mindful of the limitations and qualifications that must be stated, one must then interpret the data further by developing plausible explanations for why the causal relationship exists and what this implies about fostering student achievement gain. Here again, possibilities for error abound.

The most extreme error is to leap from a correlational finding to an extreme all-or-nothing prescription. Those who make this mistake end up urging teachers always to wait at least three seconds for a response to a question, always to praise and never criticize their students, or always to assign homework but never schedule independent seatwork. Such prescriptions stem from failure to recognize that a correlation reflects only the variation within the observed range of the teacher behavior in question, so that prescriptions for application must remain within this range. For example, suppose that rates of teacher praise (not mere positive feedback, but more personal and intensive praise) of students' correct answers to recitation questions correlate positively with student achievement gain, and that these average 10% but range from zero percent to 40% (e.g., at least one teacher never praised a correct answer

and at least one praised 40% of the correct answers that his or her students produced). Do such data imply that teachers should always praise their students' correct answers? Clearly not--the data are silent concerning rates of praise above 40%, because such rates were not observed. Therefore, it would be a mistake to extrapolate simplemindedly beyond this range (concluding from these data that teachers should always praise their students' correct answers would be akin to concluding that if 15 minutes of homework per night is good, two hours of homework per night is eight times better!).

Do the data support a recommendation that teachers praise 40% of their students' correct answers? Possibly, but probably not. This might be true if there were an extremely high correlation (.90 or above) reflecting a nearly one-to-one correspondence between the measures, so that teachers who praised at or near the 40% rate were those who got the highest achievement gains from their students and teachers who praised at or near the zero percent rate were those who got the least achievement gains. Such data would support a 40% guideline and would even provide reason to believe that the optimal percentage would be higher than 40% if teachers could be persuaded to praise even more often.

However, teacher effects research does not yield such high correlations between process measures and outcome measures. Instead of being at or above .90, even the correlations that do reach statistical significance tend to range between about .20 and .40, indicating only weak to moderate relationships between teacher behaviors and student outcomes. Such relationships reveal a general tendency for teachers who get high achievement gains to praise more often than teachers who get low achievement gains, but with many exceptions in both directions (e.g., many frequent praisers nevertheless get low achievement gains and many infrequent praisers nevertheless get high achievement gains).

Thus, even though the observed rates of praise ranged from 0% to 40%, the average praise rate for the teachers who got poor achievement gains (say, the lowest quartile) might have been 6%, and the average praise rate for the teachers who got the highest achievement gains (the upper quartile) might have been 12%.

Given this information, a sensible guideline for optimal rate of praise would appear to be about 10% to 15% rather than some higher figure. This would be a useful guideline for communicating to teachers if it proved to be robust (e.g., if it stood up to replication attempts). Even so, it would have to be communicated with attention to the limits on its generalization (it refers specifically to public praise of students' answers to questions during recitation activities; consequently it is silent about rates of praise during private interactions with individual students and about praise that might be included in feedback written on returned assignments). Also, the guideline is merely a frequency norm--it tells teachers roughly how often to praise correct recitation responses but says nothing about which students to praise, which responses to praise, or what kinds of praise would be most effective (see Brophy, 1981 on these issues).

In summary, a positive correlation between the frequency of a teacher behavior and student achievement gain usually does <u>not</u> mean that teachers should engage in that behavior at every possible opportunity, and a negative correlation between the frequency of a teacher behavior and student achievement gain usually does <u>not</u> mean that teachers should avoid that behavior en-tirely. To develop sensible norms, one must stay within the range of vari-ance in the teacher behavior that was actually observed in the data and identify a target number or range that seems to reflect optimal teacher behavior given everything known

about the nature of the process-outcome relationship and the reasons why it occurs. Usually, the average score for the most successful teachers or the range within which these teachers' scores are clustered will be the best guideline that can be developed from the data.

This has been the approach taken by Stallings (1980) to develop guidelines for reading instruction based on previous process-outcome research. These guidelines suggest, for example, that observations of good reading instruction will reveal that about 20% of class time is spent informing students (presenting new information), 2% on drill and practice, 9% on oral reading, 25% on individual written work, and so on. Such guidelines are probably better than guidelines developed on the basis of untested theoretical assumptions, and they are certainly better than the all-or-nothing guidelines criticized above. Still, they are too rigid, and if mandated as required teacher behavior rather than merely presented to teachers as food for thought, they can be counterproductive (Myers, 1986). The problem is that the guidelines are based on observational data taken at particular grade levels and averaged across repeated observations. Even as averages these data might not generalize to other grade levels (more oral reading might be appropriate in the early grades, for example, and less in the later grades). Furthermore, even when the guidelines hold up as averages, they fail to take into account shifts in the nature and lengths of activities that ordinarily should occur as the teacher and class move through an academic unit (for example, there is usually more presentation of information and development of concepts early in a unit but more practice and application activities later in the unit).

To carry this approach through to its logical conclusion, it would be necessary to do a great deal of additional research that would allow one to

generate whole families of instructional guidelines that reflected adjustments for grade level, time of year, the nature of the lesson and its place in the instructional unit, student achievement levels, and many other variables as well. Perhaps such research should be done, because the norms that it would produce might prove to be just as useful for monitoring instruction as indicators such a body temperature and blood pressure are for monitoring physical health. Even here, however, it would remain imporant not to confuse mere norms with explanatory concepts when making educational prescriptions. When patients show elevated body temperature, physicians ordinarily do not immerse them into ice water or take other action designed directly to reduce body temperature. This would be treating an index or symptom of the disease rather than the disease itself. Instead, physicians gather information about the probable cause of the elevated body temperature and respond accordingly (prescribing an antibiotic for a diagnosed infection, for example). Norms such as those concerning body temperature provide important information to help physicians recognize and respond to disease, but effective diagnosis and prescription requires consideration of the patient's symptoms within the context of a large and integrated knowledge base concerning body functioning. In other words, the data must be interpreted to decide whether or not a problem exists, and if so, what would be the treatment of choice for counteracting it.

As the knowledge base available to inform teacher education expands, the professional work of teachers should become more like that of physicians in several respects (although it should be recognized that teachers concentrate on developing their clients' cognitive structures rather than on repairing damage in their physical structures). In particular, if teachers are to function as true professionals, it will be necessary for the education profession

to develop a broad and integrated knowledge base concerning classroom functioning that would be capable of informing educational diagnosis and treatment the way the knowledge base concerning body functioning informs medical diagnosis and treatment. For this to occur, there needs to be not only a proliferation of relevant process-outcome research, but also better recognition of some fundamental principles that are routinely violated at present by those who misuse research findings.

One is that teacher behaviors are not ends in themselves but means toward ends. Usually, they cannot be labeled simply as good or bad but must be evaluated according to whether or not they foster accomplishment of the intended objectives. For example, strategies for structuring and sequencing content are most relevant to situations in which the teacher is presenting new content to the students (especially abstract or otherwise complex content). They are less relevant to brief demonstrations of specific skills and not relevant at all to activities that do not involve presentation of content. Similarly, information about the value of wait-time following questions or about simplifying questions in the attempt to elicit improved responses is most relevant to discussions involving higher level questions, less relevant to recitations involving lower level questions, and not relevant at all to activities that do not involve questioning the students. These considerations should be intuitively obvious to anyone, yet it is not hard to find teacher educators or program developers who suggest that a single lesson format is appropriate for all academic activities, or to find local administrators or state officials suggesting that a classroom observation form that assumes a particular lesson format be used for assessing instruction in all classrooms and for every kind of academic activity. Although such individuals sometimes cite selected process-

outcome research findings in attempting to justify their actions, process-outcome research considered as an integrated body of information (see Brophy & Good, 1986) provides no such support.

Rather than committing themselves to a single approach and using it in all situations (which is akin to a physician prescribing aspirin for all ills), curriculum designers and teachers should plan instruction by beginning with clear objectives, surveying known or proposed methods for accomplishing these objectives, and prescribing the method that appears to be the "treatment of choice" under the circumstances (to the extent that information is available to inform such decisions). Similarly, those who attempt to evaluate instruction should assess the degree to which the teacher selected and implemented a method appropriate for accomplishing the intended objectives, not the degree to which the teacher conformed to some supposedly generic model of good teaching.

Even if all of the data needed to implement this seemingly straightforward approach were available, however, it would be important to implement it flexibly with attention to context-specific circumstances. For one thing, teachers are always simultaneously working toward multiple objectives and trying to meet the differing needs of different students. Consequently, classroom teaching always involves dilemmas and trade-offs. Physical proximity and frequent questioning are effective nondisruptive techniques for keeping inattentive students involved in lessons, but consistent use of these techniques causes the teacher to pay less attention to and provide a lower quality educational experience for the more attentive students who are seated farther away (Lampert, 1985). Moving at a slower pace and taking time to try to elicit improved responses following incomplete or incorrect answers is helpful for low achievers, but it

reduces content coverage and may produce boredom or loss of concentration in higher achievers.

Furthermore, even generally applicable principles usually have exceptions. Confirmatory feedback is usually advisable but can be omitted when it is obvious to everyone that an answer was correct. In order to alert an anxious or inattentive student, it is sometimes better to deviate from common practice by calling the student's name before asking a question. Sometimes (such as when asking opinion questions or other divergent questions that do not have single right answers) it may be appropriate to allow students to call out answers, even though this is usually not a good idea. Thus, even relevant and valid guidelines need to be understood and used as general principles rather than as rigid rules.

In summary, research findings linking teacher behavior to student achievement gain have relevance and potential usefulness as a basis for developing prescriptions for practice, but valid use of the findings requires interpretation by educators who are knowledgeable about classroom functioning and mindful of the limitations and qualifications that must be placed on any guidelines induced from such research. Many purveyors of advice presumably based on process-outcome research have been rightly criticized for mindless empiricism or faulty generalization of findings. However, readers should note that these problems are in the use of the research rather than in the research itself. The research findings can be used to induce valid principles of instruction, and these principles can be strung together into a useful model or theory of what classroom teaching is all about and how it functions well. Much such consolidation and interpretation of the findings has been going on lately, and this process will continue.

Given that most findings were developed from research on teachers working under typical classroom conditions, there is good reason to believe that principles derived from these findings will be both relevant to and feasible for implementation by the majority of classroom teachers. For the most part, these findings underscore the important role of teachers (not just curriculum materials) in stimulating student achievement gains and the validity of most of the instructional practices that teachers have developed through intuition or reflection on their own practice. However, they also lay the groundwork for developing concepts and principles describing effective classroom teaching that should make it possible for preservice teachers to learn professional knowledge and skills more systematically than they do now and for inservice teachers to practice their profession with better integrated knowledge and more reality-based confidence.

Implications for Teacher Educators and School Administrators

As the process of interpreting, integrating, and deriving principles of instruction from the findings of teacher effects research continues, the work will become increasingly useful for informing decisions about how to maximize student achievement of academic knowledge and skills. When integrated with information about goal priorities and about methods of achieving other goals, information about maximizing teacher effects on student achievement gain will also inform decisions about how to maximize "teacher effectiveness" considered more broadly. As yet, we are a long way from possession of such an integrated knowledge base. Even now, however, principles derived from existing teacher effects research appear to have implications for preservice teacher education, induction programs for new teachers, and teacher evaluation and accountability schemes.

Preservice Teacher Education

Classroom teaching is a complex task that is difficult to learn to do well. Teachers are charged with attempting to manage the behavior and meet the instructional needs of 20-40 students simultaneously. This means that they must either teach the whole class as a group or find ways to keep the rest of the class profitably occupied while working with small groups or individuals. Consequently, no matter what methods, materials, or activities the teacher chooses to include in the total instructional program, this program will be a compromise constructed in the belief that it will allow the teacher to meet more of the needs of more of the students than any of the feasible alternatives--it will not be an ideal program that continually meets each individual student's needs. Teachers have to accept compromises by trading off classroom management benefits against costs in instructional quality and efficiency, especially in large or heterogeneous classes.

Of the various methods that have been proposed for addressing this dilemma (mastery learning, cooperative learning, individualized instruction, etc.), the traditional group-based instruction/recitation/seatwork approach is the simplest to organize and manage and has proven to be the most popular and enduring. This may be true in part simply because it is easier to manage, but I would argue that it is true primarily because, all things considered, it is the compromise that allows teachers to meet more of the needs of more of their students than any of the alternatives that are feasible within the constraints that apply (see Cuban, 1984, on this point).

Given that this traditional approach is known to be feasible and relatively effective under typical classroom conditions, and given its relative simplicity, I would argue that preservice teachers should be taught to implement it

systematically--not as the only way or even necessarily the best way to teach, but as a "starter set" of fundamental skills that provides a base to work from. A knowledge base capable of supporting such teacher education now exists. Preservice teachers not only can be informed about the group instruction/recitation/seatwork method but can receive systematic training in how to implement it and opportunities to practice what they are learning and receive feedback until they reach mastery criteria for implementing it under naturalistic conditions. In some ways, such teacher education would resemble what was done in the recent past through performance-based education or protocol materials approaches. However, there would be two important differences. First, selection of instructional skills to be included in the training would be based on empirical research findings linking these skills to student outcomes rather than merely on theoretical notions of undetermined validity. Second, rather than expect student teachers to master a great many discrete skills and then decide for themselves when and how to use them, teacher educators would teach each skill as part of a well-articulated model of classroom management and instruction and would work toward enabling the student teachers to "put it all together" as a systematic approach.

Such preparation would enable the vast majority of teachers to do at least an adequate job in most elementary and secondary teaching assignments. Then, as the teachers mastered these skills to the point of automaticity and acquired more experience and sophistication concerning their subject matter and how to teach it to the types of students they worked with, they could gradually be introduced to such refinements as (a) creating their own curricula rather than depending on what is available from commercial publishers, (b) phasing in such adaptations of the traditional model as

learning centers, simulation activities, or differentiated instruction and assignments for different groups within the class, or (c) learning alternatives to the traditional model such as open education, Mastery Learning, or individualized instruction. To attempt to teach preservice teachers these complex approaches without having first taught them the basics, however, or to give them a smattering of all of these ideas simultaneously without ensuring that they master at least one method systematically, is to violate several basic principles of developmental and educational psychology.

School District Induction Programs

I believe that school districts should sponsor induction programs for new teachers, and that such programs should concentrate on basic skills involved in organizing and managing classrooms, planning instruction, presenting content to students, conducting recitations and discussions, and managing assignments. Ideally, such programs would begin as early as possible before the beginning of the school year, so that new teachers would have the chance to inspect the curriculum materials used at the school, get started on their planning, and observe (live or on videotape) model lessons taught in the grade level and subject matter areas in which they would be working. Teachers who did not get a good preparation in fundamental skills in their undergraduate teacher education program would get such preparation here. All new teachers would get opportunities to meet as a group periodically to discuss their concerns with one or more inservice teacher educators assigned to work with them, as well as opportunities to be observed regularly and receive specific feedback (based on coding forms, checklists, etc.) from experienced teachers assigned to work with them as mentors.

Just as we use counting sticks and Cuisenaire rods as simplification aids when teaching arithmetic in the early grades, we should be prepared to use simplification aids in the early stages of teacher education: scripting of lessons, allowing use of guides and homemade outlines for quick referral during teaching, standardized responses for dealing with particular classroom management or instruction situations, and the like. For a time, this may be the only way that new teachers can cope efficiently with the complexities of their task. Ultimately, of course, we want them to become creative and flexible teachers who can select from a rich repertoire those strategies that are most suited to the immediate situation. However, it takes time to build up that kind of repertoire and to learn when and how to deviate from preestablished plans. Such development is likely to occur most smoothly if new teachers are provided with a base to work from and whatever structure and support they seem to require.

As teachers establish a basic method of operating that works reasonably well, they can begin enlarging their repertoires and experimenting with more complex methods and new challenges. Even here, though, teachers are likely to progress more rapidly if given the opportunity to work with and get feedback from one another than if left to work on their own. Methods of helping teachers to work productively with one another on cooperative inservice education projects, including methods of using research on teaching to inform these projects in ways that are helpful rather than restricting, are discussed in Good and Brophy (1987).

Teacher Evaluation and Accountability Programs

Research on teacher effects has been seriously misused in many teacher evaluation and accountability programs developed by state departments of

education and local school districts. Any such effort that in effect imposes a single lesson format on all teachers in all teaching situations is simply invalid and cannot be justified by claiming that it is supported by research on teacher effects. Even where the favored lesson format is appropriate, this approach fails to take into account the fact that there may be different but functionally equivalent paths to comparable achievement. For example, it may make no difference whether the three main ideas are summarized at the beginning or the end of a presentation, so long as they are summarized, or whether a review is done with flash cards during the lesson or through seatwork assignments afterwards. If assessment is based on whether or not a teacher follows a particular procedure rather than on the results that the teacher is able to accomplish (viewed in the light of the size and student composition of the class), there will be unfair penalizing of teachers who do not follow the favored procedure but nevertheless get results as good as or better than those of teachers who do follow it.

The implication here is that evaluators will need to develop families of forms adapted to differences in subject matter and grade level. It may be possible to assess validly general aspects of teaching such as enthusiasm, communication of positive expectations, sensitivity to and rapport with students, and success in managing the classroom and maintaining student attention to lessons and engagement in assignments using a single general form, but differentiated forms will be needed for valid assessment of curriculum and instruction. To those who say that this would involve too much trouble, I say that it is trouble worth taking to do the job right and also that in the long run it will prove much less burdensome than the trouble that will result from implementing invalid teacher evaluation procedures.

Even where families of forms adapted to differences in subject matter and grade level are available, evaluators can misuse them if they fail to take into account the objectives of the activities being observed and their place and function within the larger units of instruction being implemented by the teacher. Thus, to assess teaching sensibly and validly, the evaluator would begin by getting information about the teacher's objectives and proposed methods for accomplishing them and would then select and use observation instruments suited to the specifics of the situation. Forms or items keyed to objectives that were irrelevant or inappropriate to the activities to be observed would be omitted or adjusted.

Besides being used for evaluation purposes, data collected through classroom observation can provide valuable feedback to teachers if used in growth-promoting ways. Among other things, such use would assume the following. First, there would be a conference with the teacher prior to the observation to gather information on intended goals and strategies and negotiate the focus of the observation. The observation itself would involve a variety of methods or forms appropriate to the content and purposes of the activity. Checklists, frequency counts, or other low inference coding of discrete behaviors might be used in addition to higher inference ratings or descriptive notes focused on the quality of instruction. Ideally, the instruction would be audiotaped or videotaped for later review with the teacher.

During such a review, the evaluator would not simply interpret and draw conclusions from the raw data, but would solicit the teacher's input on points of interest (Was the teacher aware of a particular action or omission? If so, what is his or her explanation for it? Does this explanation make sense given the circumstances? Did subsequently observed events or measures of student

outcome support the teacher's explanation?). Dialogue concerning the evaluator's observations generated by such questions is likely to provide more valid assessment of the teacher and more useful feedback to the teacher than is an attempt to evaluate without the teacher's input and participation.

Evaluators also should avoid trying to make too much of limited data. Particular observations can be affected by factors beyond the teacher's control, and in any case, many aspects of teacher effectiveness cannot be evaluated validly without observing the teacher several times rather than just once, and some aspects cannot really be evaluated without knowing the day-to-day continuity of events. Classroom observations are small samples of a large and complex phenomenon, comparable to a few IQ test items administered in an attempt to assess general intellectual functioning. The information collected tends to be valid as far as it goes, but limited in reliability and scope.

Conclusion

Among its other contributions, recent research on teaching belies the notion that "those who can, do, and those who can't teach." It shows that, although most reasonably competent adults could survive in the classroom, most could not teach effectively. Teaching well is a complex and difficult task, demanding a blend of energy, motivation, and knowledge of subject matter, pedagogy, and students that many teachers, let alone other adults, do not possess. Most educational professionals realize this at some level, yet many who should know better continue to act as if teaching were something that could be reduced to a single prescription and evaluated accordingly.

One more medical analogy is a propos here: Those (including licensed physicians) who would prescribe a single treatment for all ills or claim benefits to a particular practice that go far beyond any proof to support such

claims are scorned as quacks. Educators who behave the same way deserve similar scorn.

Research on teaching, and research on teacher effects in particular, has a great deal to offer by contributing to the development of a knowledge base to inform professional practice. However, it is a misuse of such research to use it as a basis for developing simpleminded and rigid guidelines of the "Behavior X correlates with student achievement gain, so teachers should always use Behavior X" variety. To use the information appropriately, it is necessary first to synthesize it with other relevant information in order to develop explanations for observed process-outcome relationships, then derive instructional principles from this knowledge base, and then encourage teachers to apply these principles during relevant instructional situations. Development and appropriate use of a knowledge base to inform educational practice will make for better professional decision making and more confident and systematic professional practice, but without oppressing or deskilling teachers. On the contrary, in the long run the development and appropriate use of an educational knowledge base can be expected to have parallel benefits for teachers to the benefits that the medical knowledge base has had for physicians.

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